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ASSIGNMENT BOOKLET

SCN2231 Biology 20

Module 5 Assignment

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Biology 20

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Module 5

PHOTOSYNTHESIS AND CELLULAR RESPIRATION

ASSIGNMENT BOOKLET

FOR TEACHER'S USE ONLY

Summary

	Total Possible Marks	Your Mark
Lesson 1 Assignment	28	
Lesson 2 Assignment	30	
Lesson 3 Assignment	12	
Lesson 4 Assignment	34	
Lesson 5 Assignment	35	
Lesson 6 Assignment	26	
Lesson 7 Assignment	66	

Teacher's Comments

Biology 20
Module 5: Photosynthesis and Cellular Respiration
Assignment Booklet
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Students	✓
Teachers	✓
Administrators	
Home Instructors	
General Public	
Other	



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- Alberta Education, <http://www.education.gov.ab.ca>
- Learning Resources Centre, <http://www.lrc.education.gov.ab.ca>
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MODULE 5: LESSON 1 ASSIGNMENT

This Module 5: Lesson 1 Assignment is worth 28 marks. The value of each assignment and each question is stated in the left margin.

(28 Marks) **Lesson 1 Assignment: An Introduction to Photosynthesis and Cellular Respiration**

(10 Marks) **TR 2. The Chloroplast and the Mitochondrion**

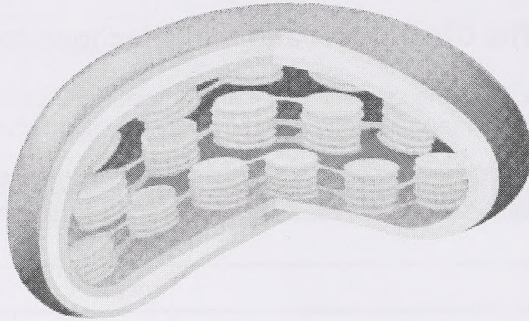
Using the following diagram, label and describe the structures listed in this chart.
(10 marks: 5 marks for labels, 5 marks for function descriptions

Chloroplast	Mitochondrion
granum	matrix
stroma	cristae
inner membrane	inner membrane
thylakoid	outer membrane
outer membrane	

Mitochondrion



Chloroplast



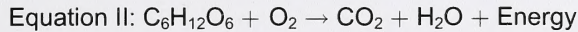
Reflect and Connect

Matter and energy flow through many pathways. From your previous knowledge of photosynthesis and cellular respiration, and from what you have learned in this lesson, answer the following questions.

(1 mark)

1. ATP is the energy molecule of cells because
 - A. it is very large
 - B. it carries an electrical charge
 - C. it contains high-energy hydrogen bonds
 - D. it contains high-energy phosphate bonds

Use the following information to answer question 2.



- (1 mark) 2. The energy produced in Equation II comes from
- A. energy from sunlight transformed by cellular respiration
 - B. glucose broken down by cellular respiration
 - C. energy in carbon dioxide and water released by cellular respiration
 - D. glucose broken down by photosynthesis
- (2 marks) 3. Explain why it is necessary for green plants to carry out both photosynthesis and respiration.
- (1 mark) 4. The conversion of light energy into chemical energy requires
- A. oxygen
 - B. glycogen
 - C. mitochondria
 - D. carbon dioxide
- (1 mark) 5. When the electrons move back to lower energy levels in an electron transport chain, energy is
- A. stored
 - B. converted to matter
 - C. released
 - D. used to make oxygen
- (1 mark) 6. The process in which cells use H^+ and e^- to produce molecules of ATP is termed
- A. chemiosmosis
 - B. glycolysis
 - C. active transport
 - D. osmosis

- (2 marks) 7. ATP is commonly known to carry energy for living cells. State two specific tasks within the body for which ATP might provide the energy.
- (1 mark) 8. During cellular respiration, carbon dioxide and water are produced when
- A. low-energy compounds, such as glucose, are reduced
 - B. low-energy compounds, such as glucose, are oxidized
 - C. high-energy compounds, such as glucose, are reduced
 - D. high-energy compounds, such as glucose, are oxidized
- (1 mark) 9. One relationship between photosynthesis and respiration lies in the fact that
- A. each supplies raw materials for the other
 - B. photosynthesis is one part of cell respiration
 - C. cellular respiration produces ATP while photosynthesis uses it
 - D. cellular respiration must occur before photosynthesis can occur
- (7 marks) 10. How does energy and matter move through the processes of photosynthesis and cellular respiration? Provide a response that outlines what you know so far about the pathways followed by matter and energy. Your responses may be written, visual, or audio (podcast). You will need to discuss
- where photosynthesis and cellular respiration occur (1 mark)
 - how matter is transported (3 marks)
 - how energy is transported (3 marks)

MODULE 5: LESSON 2 ASSIGNMENT

This Module 5: Lesson 2 Assignment is worth 30 marks. The value of each assignment and each question is stated in the left margin.

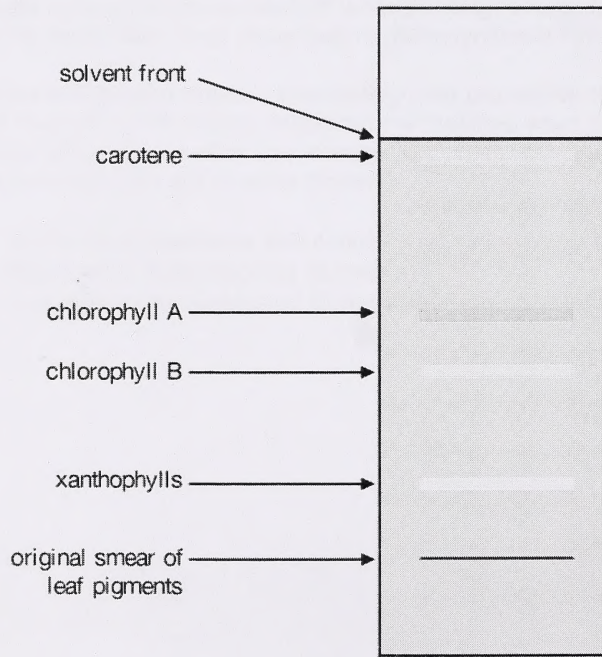
(30 Marks) **Lesson 2 Assignment: Light-Dependent Reactions**

LAB

(8 marks) **Using Chromatography to Separate Plant Pigments**

Complete the following chart. You may have completed "Investigation 5.B" from pages 172 and 173 of the textbook in a laboratory setting. If so, you may complete the following chart using your own chromatography paper from the investigation. If you were unable to perform the investigation, use the diagram provided in this assignment to help you fill out the chart. Once you have filled out the chart, answer questions 1 to 4.

Diagram of a Leaf Pigment Chromatogram



Chromatography Analysis

Pigment Name	Pigment Colour	Distance Travelled by Pigment (cm)	Distance Travelled by Solvent Front (cm)	Reference Flow (Rf)
carotenes				
chlorophyll A				
chlorophyll B				
xanthophylls				

- (1 mark) 1. The presence of pigments other than chlorophyll in plants is important because these pigments
- A. are used to build chlorophyll
 - B. can use oxygen to carry out photosynthesis
 - C. function in exactly the same way as chlorophyll
 - D. allow the plant to utilize wavelengths of light other than those used by chlorophyll
- (4 marks) 2. Describe two practical uses for an artificial chemical that behaves like chlorophyll. Explain the value of each of the uses to society.
- (1 mark) 3. If a certain band on one chromatography strip has been identified as *chlorophyll a*, chlorophyll a could be identified on a second chromatography strip by looking for a band
- A. with no colour
 - B. of darker colour
 - C. in reverse position
 - D. in a parallel position
- (2 marks) 4. Describe a practical application of chromatography, and give an example that is unrelated to photosynthesis.

Reflect and Connect

- (4 marks) 1. How can your new knowledge of photosynthesis help to solve world fuel shortages? Scientists have looked to hydrogen as an alternative clean-burning fuel. The catch is that hydrogen is not free in nature. The amount of energy required to split H_2O is more than what is obtained when hydrogen is burned. Explain why scientists are investigating ways to produce hydrogen using an artificial system similar to photosystem II.
- (10 marks) 2. Summarize in point form, by illustration, by podcast, or by poem the events that take place in the light-dependent reactions of photosynthesis.

MODULE 5: LESSON 3 ASSIGNMENT

This Module 5: Lesson 3 Assignment is worth 12 marks. The value of each assignment and each question is stated in the left margin.

(12 Marks) Lesson 3 Assignment: The Light-Independent Reactions of Photosynthesis

(12 Marks) TR 1. You Be the Critic

You have been asked to view a photosynthesis animation. Your task is to create a modified storyboard slide show or script that could be given to a multimedia developer to make this animation more suitable for you and your classmates. A storyboard template has been provided for you in Lesson 3, if you choose to use that method to present your critique. Your response must include reasons for your changes.

The following rubric will determine your mark. Each bulleted point is worth a maximum of 4 marks.

Score	Explanation
4 Standard of Excellence	- The response is well organized and addresses all the major points of the question using appropriate and clear communication strategies. - The description of relevant scientific concepts is explicit, along with appropriate reasons for suggesting changes. - Descriptions, explanations, and/or interrelationships between the concepts provided are correct and reflect a thorough understanding of photosynthesis and the chemical reactions involved.
3	- The response is organized and addresses many of the major points of the question using appropriate and clear communication strategies. - The description of relevant scientific concepts is explained, along with adequate reasons for suggesting changes. - Descriptions, explanations, and/or interrelationships between the concepts provided are correct and reflect a good understanding of photosynthesis and the chemical reactions involved.
2 Acceptable Standard	- The response is generally organized and addresses most of the major points of the question using adequate communication strategies. - The description of relevant scientific, technological, and/or societal concepts is mentioned. - Descriptions between the concepts provided are generally correct and reflect an adequate understanding of photosynthesis and the chemical reactions involved.
1	- The response is poorly organized and addresses some of the major points of the question using acceptable communication strategies. - Some mention of relevant scientific, technological, and/or societal concepts may be made.

	• Descriptions between the concepts provided reflect a poor understanding of photosynthesis and the chemical reactions involved.
0	• The response is not suitable for a Biology 20 student.

Please copy your answer to the space provided or direct your instructor to this assignment.

MODULE 5: LESSON 4 ASSIGNMENT

This Module 5: Lesson 4 Assignment is worth 34 marks. The value of each assignment and each question is stated in the left margin.

(34 Marks) Lesson 4 Assignment: Investigating Photosynthesis

(22 Marks) TR 1. Types of Photosynthesis

Use the Internet or print resources to research C_3 , C_4 , and CAM plants. Fill in the following table. Make sure to identify sources for the information you use to complete your table.

Types of Photosynthesis	C_3	C_4	CAM
Note three examples of plants of each type.	• • •	• • •	• • •
How has the process of photosynthesis evolved in each type of plant?			
Place a checkmark under the plant(s) that correspond to the following statements. more efficient use of CO_2 improved ability to survive in hot and dry conditions			

Types of Photosynthesis	C ₃	C ₄	CAM
How have scientists applied their knowledge of the different types of photosynthesis to plant productivity? (Hint: agriculture)			
Record your source information for each type of plant/photosynthesis.			

Based on your research, how do you think photosynthesis-related technologies can combat food shortages?

(12 marks) **Reflect on the Big Picture**

This is your chance to do a bit more research on photosynthesis. You may have already discovered some interesting technologies related to photosynthesis. In this activity, you will determine

- what part of photosynthesis is affected or enhanced by the technology
- how the technology benefits humans
- the current use of the technology or research

Choose one of the following technologies to research:

- hydrogen gas production
- biofuels
- sustainable agriculture
- herbicides

You may present your research in essay form, point form, through an illustration, or a slideshow.

You will be marked using the following rubric.

CATEGORY	4	3	2	1
Quality of Information	The information clearly relates to the technology chosen. Several supporting details and/or examples are provided.	The information clearly relates to the technology chosen. It provides one or two supporting details and/or examples.	The information clearly relates to the technology chosen. No details and/or examples are given.	The information has little or nothing to do with the technology chosen.
Amount of Information	All three questions are addressed with at least two bulleted points about each question.	All three questions are addressed with one or two bulleted points about each question.	All three questions are addressed, with one sentence about each question.	One or more questions were not addressed.
Sources	All sources (information and graphics) are accurately documented.	Most sources (information and graphics) are accurately documented.	Sources are indicated but are not accurately documented.	Sources are not indicated or accurately documented.

MODULE 5: LESSON 5 ASSIGNMENT

This Module 5: Lesson 5 Assignment is worth 35 marks. The value of each assignment and each question is stated in the left margin.

(35 Marks) Lesson 5 Assignment: Anaerobic Respiration

TR 1. Anaerobic Respiration → Fermentation

- (2 marks)** 1. What does it mean if you said that glycolysis is an anaerobic process?
- (2 marks)** 2. Under what conditions will fermentation occur?
- (4 marks)** 3. Describe how lactate fermentation is similar to and different from ethanol fermentation.

- (2 marks) 4. Four molecules of ATP are formed when one glucose molecule goes through the reactions of glycolysis. Is it correct to say that glycolysis yields two molecules of ATP? Explain your answer.
- (2 marks) 5. Describe what happens to the pyruvate produced during glycolysis in muscle cells when very little oxygen is available.
- (3 marks) 6. Explain this statement: Anaerobic respiration releases energy from organic compounds.

(20 marks)

Reflect and Connect

Technology has advanced in the areas of biofuel and biogas. Without an understanding of anaerobic respiration, these technologies would not exist. The products of anaerobic respiration would still be produced, but not used to the benefit of humans.

Use the Internet to research biofuel and biogas development in Canada. Compile a report detailing the similarities and differences between these substances. Charts can be a good way of comparing and contrasting. Since you are gathering and collecting information from a variety of sources, make certain to use your own words and identify the references you have used. You may present your report as a written document or as a slide show.

Be sure to include the following information in your report:

- Identify the raw material used to make biofuel and biogas. Identify alternative raw materials that can also be used to produce the same product.
- Create a graphic that lists the steps used to produce biofuel and biogas. You can use diagrams from the Internet for ideas, and you can use clipart to help with diagrams, but do not copy flow charts off the Internet.
- List possible uses for biofuel and biogas.
- Write the chemical formulas for biofuel and biogas. Explain the statement that *biofuel and biogas still represent energy-rich compounds*. Compare the chemical composition of each substance to carbon dioxide, which is the product of the complete oxidation of glucose.
- What are some of the problems associated with the processes used to produce each of these substances?

You will be marked according to the following rubric. Note that you will receive a maximum total of four marks per bullet, with a possibility of eight marks for the first bullet.

Score	Report
4 Standard of Excellence	• The response is well organized and addresses all the major points of the assignment using appropriate and clear communication strategies. (x 2) • The comparison and contrast of biogas and biofuels is clear. • The graphic created is correct and reflects a thorough understanding of anaerobic respiration and the chemical reactions involved. • All sources have been accurately documented.
3	• The response is organized and addresses many of the major points of the assignment using appropriate and clear communication strategies. (x2) • The comparison and contrast of biogas and biofuels is adequate. • The graphic created is correct and reflects a good understanding of anaerobic respiration and the chemical reactions involved. • All sources have been accurately documented.
2 Acceptable Standard	• The response is generally organized and addresses most of the major points of the assignment using adequate communication strategies. (x2) • The comparison and contrast of biogas and biofuels is mentioned but not developed. • The graphic created is generally correct and reflects an adequate understanding of anaerobic respiration and the chemical reactions involved. • Most resources have been accurately documented.
1	• The response is poorly organized and addresses some of the major points of the assignment using acceptable communication strategies.(x2) • Some mention of comparison and contrast of biogas and biofuels may be made. • The graphic created reflects a poor understanding of anaerobic respiration and the chemical reactions involved. • Some sources have been identified, but not accurately documented.
0	• The response is not suitable for a Biology 20 student.

MODULE 5: LESSON 6 ASSIGNMENT

This Module 5: Lesson 6 Assignment is worth 26 marks. The value of each assignment and each question is stated in the left margin.

26 Marks) Lesson 6 Assignment: Anaerobic Respiration

(6 marks) TR 1. Comparing Chemiosmosis in Photosynthesis and Cellular Respiration

Chemiosmosis, the movement of hydrogen ions to make ATP, was introduced in Lesson 3 as you learned about photosynthesis. Prepare a list of three similarities and three differences between chemiosmosis in photosynthesis and chemiosmosis in cellular respiration. Your list may include diagrams to illustrate. You may choose to create a slideshow presentation or a podcast of your list. Indicate in the space provided where your teacher may access this activity if it cannot be directly put into this document.

TR 2. Estimate Your VO_2 Max

Caution

If you have a medical condition that prevents you from participating in physical education classes, you should not participate in the exercising part of this activity.

Although a VO_2 measurement requires sophisticated equipment, there are a number of methods that you can use to estimate your VO_2 max. You may have chosen to do the VO_2 max step test or “ VO_2 max from non-exercise data” test. The step test was outlined for you in Lesson 6. You needed to complete a web search in order to calculate your VO_2 max and to find alternative tests if you were unable to complete any physical activity.

Use the following scenario and charts to answer the questions in this activity.

Greg, a young man of 27, performed the VO_2 max step test. For three minutes, he stepped up and down the bottom step of his stairs at the rate of 24 steps per minute. At the end of three minutes, he found his pulse and counted for 15 seconds. He counted 40 beats. His heart rate was 160 bpm.

He used the Internet to find a site to calculate his estimated VO_2 max. Greg entered his gender and heart rate. His estimated VO_2 max score was 44.13 mL/kg/min. He wondered what his score would be if he were a female so he changed the gender rating on the site. The calculation was 36.36 mL/kg/min.

Female (values in mL/kg/min)

Age	Very Poor	Poor	Fair	Good	Excellent	Superior
13-19	<25.0	25.0 - 30.9	31.0 - 34.9	35.0 - 38.9	39.0 - 41.9	>41.9
20-29	<23.6	23.6 - 28.9	29.0 - 32.9	33.0 - 36.9	37.0 - 41.0	>41.0
30-39	<22.8	22.8 - 26.9	27.0 - 31.4	31.5 - 35.6	35.7 - 40.0	>40.0
40-49	<21.0	21.0 - 24.4	24.5 - 28.9	29.0 - 32.8	32.9 - 36.9	>36.9
50-59	<20.2	20.2 - 22.7	22.8 - 26.9	27.0 - 31.4	31.5 - 35.7	>35.7
60+	<17.5	17.5 - 20.1	20.2 - 24.4	24.5 - 30.2	30.3 - 31.4	>31.4

Male (values in mL/kg/min)

Age	Very Poor	Poor	Fair	Good	Excellent	Superior
13-19	<35.0	35.0 - 38.3	38.4 - 45.1	45.2 - 50.9	51.0 - 55.9	>55.9
20-29	<33.0	33.0 - 36.4	36.5 - 42.4	42.5 - 46.4	46.5 - 52.4	>52.4
30-39	<31.5	31.5 - 35.4	35.5 - 40.9	41.0 - 44.9	45.0 - 49.4	>49.4
40-49	<30.2	30.2 - 33.5	33.6 - 38.9	39.0 - 43.7	43.8 - 48.0	>48.0
50-59	<26.1	26.1 - 30.9	31.0 - 35.7	35.8 - 40.9	41.0 - 45.3	>45.3
60+	<20.5	20.5 - 26.0	26.1 - 32.2	32.3 - 36.4	36.5 - 44.2	>44.2

- (1 mark) 1. Explain what a VO_2 max test tells you.
- (3 marks) 2. If Greg had not finished the test, how would that affect his results? Provide reasons for your response.
- (1 mark) 3. How did Greg rate in terms of his ability to use oxygen?
- (2 marks) 4. How do you think Greg's values would compare to a VO_2 max test done in a lab?

- (4 marks) 5. What does it mean, in terms of aerobic respiration, if your VO_2 max value is high? Low?
- (3 marks) 6. What is the relationship between heart rate and cellular respiration?
- (3 marks) 7. Why is the VO_2 max value for a woman less than it is for a man who has the same heart rate?
- (3 marks) 8. How does VO_2 max technology benefit humans?

MODULE 5: LESSON 7 ASSIGNMENT

This Module 5: Lesson 7 Assignment is worth 66 marks. The value of each assignment and each question is stated in the left margin.

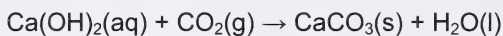
(66 Marks) Lesson 7 Assignment: Investigating Cellular Respiration

LAB. Oxygen Consumption and Heat Production in Germinating Seeds

When seeds germinate, they use cellular respiration to release stored chemical energy that will enable the growth of the seedling. As you have learned in previous science courses, oxygen is an important reactant in this process. In this activity you will investigate the level of cellular respiration of germinating seeds by measuring their oxygen use and heat production.

Background Information for Part 1

Plants produce carbon dioxide as they respire. In order to keep the carbon dioxide from changing the volume of gas in the test tube, lime water is added. Lime water is a solution of calcium hydroxide, and it reacts with carbon dioxide to form the precipitate calcium carbonate.



Using lime water to absorb carbon dioxide gas restricts factors that may change the volume of the gas in the system to only changes associated with the concentration of oxygen.

PART 1: Oxygen Consumption in Cellular Respiration

Problem (Purpose of the Lab)

What is the effect of germinating seeds on the volume of gas in a controlled environment?

(2 marks) Hypothesis

Create a hypothesis using the two steps provided in Lesson 7.

Materials

If you are completing this lab according to the textbook the materials used in this investigation are listed on page 184.

Procedure

Step 1: Prepare a table with sufficient space to record respirometer data for two different types of seeds for 15 minutes.

Step 2: Follow the Part 1: Procedure outlined on page 184 and 185 of your text. If you are completing the virtual lab, follow the steps described in the electronic presentation of this lab. You can access the virtual lab from Lesson 7.

Step 3: Record your data in your data table.

(4 marks)

Observations

Insert your data table into the space provided.

Analysis

Answer the following questions.

(2 marks)

1. What could be a possible source of error in your procedure or data collection? Why?

(2 marks)

2. Did the volume of gas in the test tube increase or decrease during this simulation? Provide reasons for the change in the volume of gas in the system.

- (2 marks) 3. Did both seed types tested have similar respiration rates?
- (2 marks) 4. Several errors were made in the design of this lab. These flaws mean that the data will not be reliable. Describe two changes to the design that could improve this lab.
- (1 mark) 5. A student fills a second test tube with only lime water and tissue but no seeds. The test tube's volume does not decrease as much, but it still decreases slightly. Why would you expect the second test tube to show this small drop in volume?

- (3 marks)** 6. A student decides to modify the experimental design by covering the test tube in tinfoil. By making this modification to the experimental design, identify the factor being investigated. Write a hypothesis that indicates the expected outcome of this experiment, along with support for your predictions.

- (4 marks)** 7. Complete the table below. To complete the first row, you may wish to use an online dictionary or a print dictionary. To complete the second row, write suggestions about how this experiment could be modified to include a control group. Note what effect this might have on the experiment results.

	Controlled Variables	Control Group
Definition		
Examples from your lab		

Part 2: Heat Production in Cellular Respiration

(16 marks) All organisms produce heat as they use ATP in cellular respiration. In this part of the investigation you need to create an experimental plan that demonstrates that heat is a product of germinating seeds. You may submit your experimental plan on a separate sheet of paper or in an electronic file. You will be marked on your experimental design using the following rubric.

CATEGORY	4	3	2	1
Experimental Hypothesis	Hypothesized relationship between the variable and the predicted results is clear and reasonable based on what has been studied.	Hypothesized relationship between the variable and the predicted results is reasonable based on general knowledge and observations.	Hypothesized relationship between the variable and the predicted results has been stated, but appears to be based on flawed logic.	No hypothesis has been stated.
Replicability	Procedures appear to be replicable. Steps are outlined sequentially and are adequately detailed.	Procedures appear to be replicable. Steps are outlined and are adequately detailed.	All steps are outlined, but there is not enough detail to replicate procedures.	Several steps are not outlined AND there is not enough detail to replicate procedures.
Procedures	Procedures are listed in clear steps. Each step is numbered and is a complete sentence.	Procedures are listed in a logical order, but steps are not numbered and/or are not in complete sentences.	Procedures are listed but are not in a logical order or are difficult to follow.	Procedures do not accurately list the steps of the experiment.
Components of the report	All required elements are present and additional elements that add to the report (e.g., thoughtful comments, graphics) have been added.	All required elements are present.	One required element is missing, but additional elements that add to the report (e.g., thoughtful comments, graphics) have been added.	Several required elements are missing.

Analysis

- (2 marks) 1. What could be a possible source of error in your procedure or data collection? Why?
- (2 marks) 2. Explain what kind of results would support your hypothesis.
- (2 marks) 3. Predict results of your investigation if you let it run for a longer period of time (a few days or a week). Justify your prediction by explaining your reasoning.

TR 1. The Effects of Metabolic Toxins on Cellular Respiration

Turn to “Thought Lab 5.3” on page 189 of the textbook. You will be asked to research a metabolic toxin and create a Metabolic Toxin Profile based on the information you have collected. You can present the profile in a variety of formats such as PowerPoint, a poster, a report, or a podcast. You must, however, include an introductory paragraph that summarizes the results of your research. You will also be constructing a comparison chart between the toxin you chose to research and two toxins that other students have researched and posted in the discussion area.

(12 marks) Procedure

1. Choose one of the following metabolic toxins to investigate:
 - antimycin
 - cyanide
 - hydrogen sulfide
 - malonate
 - oligomycin
 - rotenone
 - arsenic
2. Find four different sources of information about your chosen metabolic toxin. Include information from two print sources and two electronic sources. Search for and collect the following information:
 - What are the metabolic toxin's physical properties?
 - When and why was it first developed and used?
 - How does the metabolic toxin work? (That is, what is its effect on metabolism?)
 - How dangerous is it?
 - What, if any, evidence is there to link the metabolic toxin to human disorders?
 - What, if any, antidotes or treatments for exposure are there?
3. Create a “Metabolic Toxin Profile” for the toxin you investigate. Your profile should include an introductory paragraph that summarizes the results of your research findings. You can present the profile in a variety of formats such as PowerPoint, a poster, a report, or a podcast. Use appropriate headings to organize the information in your profile. Also include the sources of information you have used to construct your profile.
4. Post your profile in the discussion area so that other students can view your research results. You will be constructing a comparison chart between the toxin you chose to research and two toxins that other students have researched and posted in the discussion area.
5. Submit your Metabolic Toxin Profile with this document on a separate piece of paper or in an electronic file.

6. Once you have constructed your comparison chart, submit your chart with this document on a separate piece of paper.

The following rubrics will be used to mark your profile and comparison chart.

CATEGORY	4	3	2	1
Quality of Sources	Researchers independently locate at least four reliable, interesting information sources for research on a metabolic toxin. Two are print resources; two are electronic resources.	Researchers independently locate four reliable information sources for research on a metabolic toxin. There are more electronic resources than print resources	Researchers locate four information sources for research on a metabolic toxin. There are more electronic resources than print resources.	Researchers locate less than four information sources for research on a metabolic toxin. There are more electronic resources than print resources.
Presentation	Students have presented a clear and organized profile. All six questions from procedure 2 are answered with excellent detail. There is a well-organized introductory paragraph.	Students have presented a clear and organized profile. All six questions from procedure 2 are answered with adequate detail. There is an organized introductory paragraph.	Students have presented a profile requiring further organization. Some of the six questions from procedure 2 are answered with adequate detail. There is an introductory paragraph.	Students have not presented a clear or organized profile. Some of the six questions from procedure 2 are answered with adequate detail. There is no introductory paragraph.
Comparison	Students compare two other metabolic toxins. The format of the comparison makes it easy to compare the toxins for each of the six questions asked in the procedure.	Students compare two other metabolic toxins. The format of the comparison requires further organization to make comparisons clear for each of the six questions asked in the procedure. Students compare two other metabolic toxins. The format of the comparison makes it easy to compare the toxins for each of the six questions asked in the procedure.	Students compare one or two other metabolic toxins. The format of the comparison requires further organization to make comparisons clear for each of the six questions asked in the procedure. Some comparisons are missed.	Students compare one other metabolic toxin. The format of the comparison requires further organization to make comparisons clear for each of the six questions asked in the procedure. Some comparisons are missed.
Discussion Posting	Students post their responses to the discussion area.			

Analysis

Complete Analysis questions 1 and 2 from "Thought Lab 5.3."

(1 mark) 1.

(1 mark) 2. a.

(1 mark) b.

(2 marks) c.

(3 marks) d.

(2 marks) e.

Once you have completed all of the questions, submit your work to your teacher.

